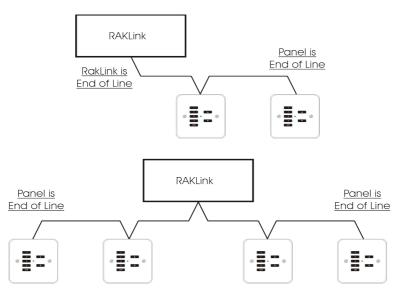# RakLink Diagnostics and Useful Information

The RAKLink is the link between the external data network for devices such as WCM keypads and the internal network for the RAKs.

A Rako wired network should work faultlessly. Any intermittent problems or trouble communicating with devices or particularly long upload times are all indications of network problems. The most common cause of problems with any wired system is cabling faults.
Below are some guide points to help the installer to avoid or identify and rectify any such problems.

Wiring layout – A Rako wired network needs to be one daisy chain network. A RAKStar forms a daisy chain from individual home or star wiring cable runs. The details of how the RAKStar achieves this is covered in the RAKStar manual or the document 'RAKStar diagnostics'.
Without a RAKStar a single daisy chain must be formed although it is possible that the RAKLink is in the middle of the network (see diagram below)
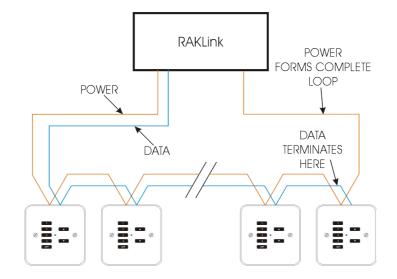

Termination – A Rako wired network needs end of line termination at each end, this is achieved using the jumper connectors on the device. A system as simple as a single RAKLink connected to a Bridge still requires this termination. Each end of a network should have normal (not Star) termination.
Note: A RAKStar has a built in termination.

Network overview – The network broadly comprises of two components, power and data. The cores used and their functions are given below

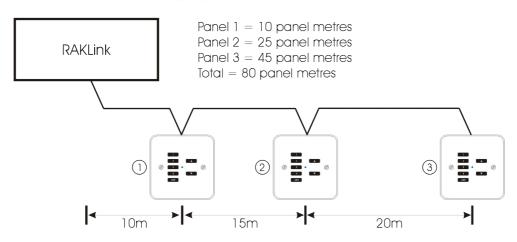| Core colour	Function	Typical voltage DC with respect to 0V
Green/White	Data + (return RAKStar only)	2.5-3V
Green	Data – (return RAKStar only)	2.5-3V
Brown	Power –	0V
Brown/White	Power +	15V
Blue/White	Data +	2.5-3V
Blue	Data -	2.5-3V
Orange	Power –	0V
Orange/White	Power +	15V

On a daisy chain network the Green Green/White cores are not used, they are only used as data return cores for a RAKStar network. The daisy chain rule is a requirement for the data whereas the power can indeed be fed from anywhere, in situations where volt-drop may be an issue (see below) cabling the network as a loop may be beneficial. Whilst two ends of the loop should not be fully connected it may help to feed the power from both ends, see diagrams below.

Cable Lengths and Volt Drop – The maximum CAT5 network run is 3km for the data. The maximum CAT5 run distance for power however is governed by the volt-drop which is in turn determined by the core size of the cable, distance and number of devices drawing power from the network. The devices will stop functioning if the supply voltage drops below approximately 10V DC.

Maximum number of keypads – A RAKLink power supply has the capacity to power 30 keypads (no limit on data) if all the keypads were to be mounted next to the RAKLink. As this is not how keypads are positioned in reality the volt-drop along the CAT5 cable also needs to be considered and may reduce the maximum number of keypads substantially. The actual number that can be connected to one RAKLink is calculated as 1000 panel metres where the number of panels and the distance of each from the RAKLink is also taken into account. See below for an example of panel metre calculation.

Example panel metre calculation

Panel 1 = 10 panel metres
Panel 2 = 25 panel metres
Panel 3 = 45 panel metres
Total = 80 panel metres

Note: This calculation is not applicable to installations with RAKStars. Each leg of a RAKStar starts with a full 15V so the practical limit is 30 keypads.

Indication that the voltage has dropped too low. - At the extreme indicator LEDs on wallpanels and other devices will not light. At marginal voltages WCM wallpanels will continuously flash the LED on button 4 (for a WCM070 or WCM100 layout). Alternatively the voltage can be measured using a multi-meter according to the voltage table above.

Correcting a low supply voltage – There is no reason that the network power supply should only be fed from a RAKLink. It is quite feasible to boost the power supply by connecting further power supplies. As the minimum voltage is 10V a 12V supply is adequate. Any power supplies connected to the network should be fully isolated and have a maximum current limit of 3 Amps. Greater current capacity risks damaging the CAT5 cable in a short circuit situation.

EtherBridge and Excessive Cable Lengths - It is unlikely that the 3km data length will be exceeded in a daisy chain style network, however a Star wired network has a separate length of data cable to each leg and indeed the actual data length is doubled, as the data returns to the Star. It is possible to form two separate networks linked by an Ethernet cable, in this case two Bridges will be required, one at either end of the Ethernet cable, see the document 'EtherBridge Set up' for more information. EtherBridge can also be used for other applications, for example where two buildings on the same property are connected by the same Ethernet cable but where there is no option to run extra cabling for the Rako wired network.

Indicator LEDS - The RAKLink has three indicator LEDs, one on the lower power tray and two (D1 and D2) on the top punch-down PCB. The LED on the lower power tray should be permanently lit and indicates 15V power is present on the internal network from the RAK4s.

LED D2 – D2 on the top circuit board should also be permanently lit and indicates that 15V is present from the mains PSU within the RAKLink. If D2 is not lit, or goes out whilst commissioning it indicates that the network power line has been short circuited. If this happens a re-settable fuse (on the circuit board) has tripped. This can be re-set by power cycling the RAKLink once the fault has been cleared.

LED D1 – D1 is normally unlit and flashes when the RAKLink has been put into set-up mode, it also flashes faster when 'pinging' the network, see below:

Pinging - Pressing the blue microswitch first (after 5 seconds) puts the RAKLink into set-up mode, holding the switch for a further 3 seconds the LED D1 will start to flash faster. This indicates the RAKLink is 'pinging' other network devices. Other devices that can hear the pings respond by flashing their indicator LEDs. In the case of other RAKLinks this will be D1 flashing. For wallplates the LEDs behind the buttons start a cycle on the left hand side buttons from bottom to top. This is a useful diagnostic tool when checking network connections. Devices that do not respond to pings are not receiving messages from the sending RAKLink, indicating a data fault. To exit pinging mode press the blue microswitch again.

Upgrading firmware – This is often the first resort of an installer trying to troubleshoot a network. It may be that there are firmware updates available but it is highly unlikely that the lack of the most recent firmware version is causing any networking issues. Firmware upgrades are usually to implement or support subtle programming options. Upgrading firmware itself often causes more issues as it adds one more variable into a troubleshooting scenario. Should an upgrade be necessary it is important that there is no network traffic (button presses, PIR detections etc whilst the upgrade is in progress) and should only be carried out after instruction by Rako support staff.